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THE SOCIAL RESPONSIBILITY OF THE ENGINEER[1]

By Dr. F. G. COTTRELL

RESEARCH ASSOCIATES, INC., WASHINGTON, D. C.

IT is with very genuine pleasure and appreciation that I come here to-night, for in thus responding to your friendly and generous invitation and in adopting your chairman's suggestion for the subject and title of my remarks, I feel that it is primarily as a group representative for certain social ideas or way of life rather than as an individual that I am speaking to you.

There seems to be a wide-spread feeling, with which I heartily sympathize, that scientists and engineers as a class have a peculiar responsibility to society for leadership in certain directions which they have on the whole as yet, perhaps, not fully appreciated.

While this has been a matter of long standing, the acute social and economic problems facing the world to-day emphasize the importance of an awakening to the issue.

Thorstein Veblen has perhaps most clearly sounded this challenge in "The Engineers and the Price System." The gist of Veblen's plaint is that while scientists and engineers are largely responsible for our material progress in the present age, they are so preoccupied and satisfied with these functions that they allow themselves to become mere cogs in the social-economic machine, which falls thereby all too readily and exclusively into hands whose training has been purely in trade and finance and thus dominantly directed to the goal of profits as contrasted with use or service.

There is sound wisdom in Veblen's exhortation of the scientists and engineers to take a more active interest and responsibility in the social economic side of life, for both by temperament and training we have a right to expect them to think most naturally in terms of service and utility.

[1] Address on the occasion of the presentation of the Washington award at a meeting of the Western Society of Engineers, Chicago, February 23, 1937.

However, the young engineer in college and just as he is emerging therefrom is in a very difficult situation to-day with regard to these deeper lying social responsibilities of his profession, because our whole social order, if not actually undergoing a profound fundamental change in the relative weight assigned to property and human values, is at least a battle ground for the forces representing the struggle between conservative and radical thought and interest, divided along just these lines of cleavage.

The engineer's work has to do naturally with material things, and with material things on a large and expensive scale—in other words, primarily with property values. He thus comes in ever increasing degree, as his experience and responsibilities multiply, to be thrown with and have to look to men whose primary training and duty it is to consider everything from this property aspect. Our whole industrial system has perforce been built up chiefly upon this plan, while its impacts on human needs and relations, in so far as not automatically adjusting themselves under a *laissez-faire* system, have been vaguely left to the professional sociologists, economists and legislators to ponder and attempt solutions through education of the public and regulatory legislation.

What I want to bring out is the crying necessity and splendid opportunity for the young engineer of creative imagination and moral courage to join forces with his brother specialists from the humanitarian side and thus insure a really comprehensive picture of what *homo sapiens,* in this year of grace 1937, should be driving at as the immediate and conscious goal for the species.

I believe we must fairly face the fact that whether we like it or not, our fundamental and generally accepted basis for morality, including the fundamental principles of democracy, has finally run head-on into some of our most solidly established legalistic extensions and interpretation of man's earlier, simpler and more personal conception of property ownership. Ironically enough, the doctrine of sanctity of property apparently originated in the mind of man largely to protect him against the dangers of unemployment. But now in its modern extensions to corporate ownership it is receiving chief blame from many for national unemployment.

That is to say, from the democratic and *laissez-faire* standpoint, before the era of mass-production and giant power, the recognition of the essential sanctity of private property and the obligation of the state to protect the individual therein against marauders large or small, became the individual's best possible guarantee that with ability, industry and willingness to work, he could always create and maintain for himself and family a home and workshop furnishing shelter, productive employment and, through the latter, such other necessities and luxuries of life as to give him his fair chance in reference to the living standards of his age.

The coming of the industrial revolution and centralized factory system, first in Europe and later in our own country, followed many years later, but especially in this country, by the final closing of the frontier through progressive pioneering with the eventual absorption into private ownership of all worth-while land and other natural resources, tremendously reduced the significance of property ownership by the average man, in so far as security of employment was concerned. To be sure, there is still room for some little workshops and individually owned factories, but their possible number relative to population is so pitifully small that they are no longer a significant factor in unemployment. Even for the skilled craftsman, individual ownership of his tools has steadily waned almost to the vanishing point. The real tools of major industry are now so exclusively held in ever-growing corporate ownership that the relation of property rights to mass unemployment may justly be considered entirely from this standpoint.

Thus over the years the legal fiction of the corporation has gradually insinuated itself between the artisan and his tools. Nor would his saving and investment in his share of these tools through ownership of the shares of the corporation give him, under existing law, any assurance of access to these tools whereby to earn his livelihood. Thus has one of the most fundamental and significant meanings of property rights undergone a terrifying change for the vast majority of our population and largely without our realizing it.

Here again the engineer should be in a most strategic position to intelligently yet sympathetically understand and interpret the situation to the ultimate authorities, both public and private, for it behooves us to remember in all this that the corporation as a fictitious legal person is the creation of the state, and it has been largely through the interplay of both physical and human engineering that corporate methods and management have now come to play so large a part in our national life and in our destinies as individuals.

These corporate structures and methods have certainly been a most powerful, if not indispensable, tool in the development of present-day science and engineering; but I think it is safe to say that the public, as a whole, to-day has greater confidence and respect for the ability and judgment of the engineer than for that of the business and financial management. In a sense the engineer stands as a connecting link between the public and the management, for the engineer in dealing more closely with physical details comes also more closely in contact with labor and the human side of these problems, and this is the aspect which the late

depression has so vividly shown us to be the part of our industrial structure which most needs attention and revision.

It is true, the fundamental conception and even the structure of our corporate law has come down to us with little change from the Romans, beginning there with the state and its minor subdivisions and extending to various social groups, but it is only the last half century which has seen its full flowering into the dominant and almost universal form of larger business undertakings.

The legalistic conception of the corporation as a fictitious person has apparently left even to the present day much interpretation still pending as to how completely the corporation is to assume not only human rights but human responsibilities. Perhaps the corporation is only showing a human characteristic in tending at times to stress its rights more than its responsibilities, feeling perhaps, again quite humanly, that the public, in the long run, can adequately take care of its own interests. However, there seemed until recently to have been a rather general, even if tacit, assumption that the more personal and intangible elements of human character and responsibility should hardly be looked for in a corporation, as tersely expressed in the old and well-worn saying that it "has neither a body to be kicked nor a soul to be damned."

But under the growing intricacy and intimacy of corporate relations with every detail of human life, may we not logically expect the public to progressively demand a higher and higher development within the corporate brain or management of something more analogous to what we think of as the finer and more intangible portions of human personality and responsibility? It seems to me that in his opportunity to help develop and rationalize some of these tendencies, the engineer holds a unique position both from his training and his peculiar position in the corporate structure. He is under less direct pressure than the business management to act exclusively under the profit motive, but is distinctively associated in everybody's mind with the function of service.

With an over-dominant financial- and promotional-minded management, he may, it is true, be under considerable pressure to focus these service efforts not so much on broad utility to the ultimate consumer nor improvement in working conditions of the staff and labor force, but rather with a single eye to increase profits and decrease costs at any cost. Just here, however, comes perhaps his real opportunity for social service in quietly and tactfully resisting undue pressure in this regard, even if it means a certain amount of hardship and risk to his advancement or even his position itself. In the extreme case, he may have the decision to make as to whether he can accomplish more for the general good by staying on where he is and systematically exercising this influence for whatever gains he may thereby be able to accomplish or whether he will be more useful on the whole by stepping out in favor of some one either more pliant or already committed to the management's point of view, while he himself seeks more promising soil in which to plant or cultivate these newer challenging variants of our social evolution.

Fortunately there is already a great deal of such ground to build upon, and it distinctly represents a two-way channel of exchange. I know of nothing more inspiring in business and industry than to see the deep-rooted and sincere loyalty of many employees and officials to their corporations. They, at least, certainly sense them as something more than a purely fictitious personality. On the other hand, there is an ever-growing circle among the corporations coming to appreciate their more human responsibilities in a deeper and deeper sense, and making every effort to find ways of expression. But especially in the larger corporations this often becomes a herculean task, chiefly from the size of the organization and the background of legal tradition and conservatism built up over the years out of our earlier limited interpretation of corporate personality. Where these traditions have been most directly broken through and a more progressive attitude established, it can usually be traced back to the presence of one or more outstanding individual personalities within the corporate management and staff, who have gradually built up their circle of sympathetic and vigorous spirits about them working in this direction. And here again is where the engineer can play so strong a part not only in his primary leadership in the matter, but in his helpful cooperation with others, both superiors and subordinates, in working to establish such traditions.

In town and village industries of old, owners, workers and consumers blended into a single compact community, the three classes largely overlapping. With the coming of our national corporations, all this has changed and in the typical case the three classes are quite distinct, though of late years definite and even strenuous efforts have been made by certain corporations to again interrelate the groups, as by stock allotments under favorable conditions to employees or stock sales campaigns among the consumers or clientele, as notably, for instance, by the American Telegraph and Telephone Company and other utilities. A still older and more complete application of the principle is, of course, the mutual insurance company. But this is too special a case to serve as a general pattern.

Of much more significance as a widely applicable pattern is the consumer cooperative movement, which had its origin, strangely enough, in almost exactly its

present-day corporate form through the registration on October 24, 1844, of the "Rochdale Society of Equitable Pioneers" in Toad Lane of this little factory town in northern England. Its growth, though steady and important, has been so unspectacular that its possible wide-spread importance as a social-economic factor has crept on us rather unawares, especially in this country, until within the last few years. But the prominence that it is now receiving in both the public and the technical press is rapidly acquainting all classes with its history and present status. Its world-wide strength has naturally sprung from the people with small incomes, and its already impressive world-wide manufacturing and merchandising operations are controlled and directed almost exclusively by men who have risen modestly from the ranks. Though now claiming to serve over two hundred million people throughout the world, it has the distinction of a remarkable degree of all-over efficiency coupled with strict adherence to its original severely democratic principles. As a background against which to examine our own national typically capitalistic business structure, it furnishes much food for reflection. In fact, so much so that of late months it has been freely asserted in several of the national trade journals that certain of our largest chain stores and mail order houses were seriously considering the expediency of remodeling their structure and customer relations very much along these same lines.

As a strongly suggestive study in contrasts, I would earnestly suggest to my socially minded engineer friends the worthwhileness of becoming thoroughly acquainted with this movement's history and present rather amazing growth in this country, particularly among the farming element. My reason for saying this is not that the movement has notably invaded the engineering field, particularly in the latter's more pioneering aspect, but rather for just the reverse reason, namely, that it has gone so far in other directions without apparently attempting or encouraging any bold pioneering of the engineering or fundamental science research type. This is entirely natural and to be expected, since the most dominant principle running through the movement as a whole, and which has undoubtedly contributed most to its stability and steadiness of growth, is the sustained and consistent effort to eliminate speculative motive both among its members and in the organization itself. This may prove the very factor which will limit its ultimate growth in displacement of typically capitalistic industry as we know it to-day. For it is in pioneering in new technical and industrial developments which at the start seem too uncertain in their results to be considered anything but speculative that the combination of high engineering skill and American methods of finance and management has been most successful and won world-wide acclaim.

It may be that the combination or rather working side by side of these two strikingly contrasted industrial systems is what we shall come to. The one under individual initiative would provide for constant pioneering and development of the frontier of applied science and industry, thus insuring the element of diversification in both products and human activities under the frankly exciting and stimulating conditions of typical pioneering, with all its traditional hazards and rewards, its headaches and waste for those who have the temperament and the hardihood to consciously and with deliberate choice elect this road. The other, the Cooperative, perhaps less spectacularly but none-the-less importantly would take over the industries and improvements thus established as they gradually become standardized, and thus freed from their original speculative aspects, eliminate the waste of excessive competition, advertising and promotion, guard against paying unjustifiable tribute to any special interest or group, and give the great, relatively colorless but none-the-less deserving consuming public at last an impersonally measured fair equivalent for its money or its services in return for such goods and services as can be produced and exchanged in this standardized way.

Here again, I believe, in the interrelation of these two groups and the establishment of their most fitting and efficient boundary relation is a splendid opportunity for the studies of the real engineer who knows not only his physics and his chemistry, but can judge and weigh human and service values as well. For verily there is a place for everything and we shall all be happier as each thing moves at least toward its allotted place.

Somewhat as the consumers cooperative movement has already found this large and important place for itself in the field of well-established household commodities alongside of ordinary capitalistic business and industry, there is also another, as yet much less pretentious and more tentative set of experiments being made over on the side of strenuous scientific and industrial pioneering, which have particularly interested me over the past 30 years and perhaps largely influenced the view-point presented to you this evening.

This group is probably best known to most of you through the industrial research foundations of various universities. My own most direct experience has been with the Research Corporation of New York City and its two-year-old little brother, Research Associates, Incorporated, in Washington, D. C. These are both non-profit business corporations, if you will permit such an apparently self-contradictory definition; meaning in any case that while they attempt to fune-

tion in the same manner and general field as any privately owned and ethically operated business, they pay no dividends to personal stockholders. All income above expenses not held for reserves or needed for operating capital is expended currently to aid scientific and educational institutions in the prosecution of research.

Briefly, these two corporations may be said to hold a place and typify a new class midway between such privately endowed research and welfare foundations as Carnegie, Russell Sage, Rosenwald, and the like on the one side, and university research foundations, such as those at Wisconsin, Purdue and, more recently established, Ohio State on the other. They differ from the first category in starting with no large monetary endowment, that interest or dividends on securities purchased as investment are not intended ever to be a significant factor in their income, but that normally they earn their way currently through services in invention development and production for use.

They differ from the university foundations on the other hand chiefly by being entirely free from commitments to any one institution and thus being able to work with any and all of them, either individually or collectively. Also as yet the university foundations appear to have been conceived and administered almost exclusively from the standpoint and hope of revenue for further scientific research in the universities than with definite intent to use them as laboratories in social economics, which latter I have particularly tried to emphasize as the outstanding opportunity and characteristic among the purposes of Research Corporation and the Associates. That is, they are frankly willing to risk or even sacrifice on occasion possible legitimate profits from the licensing or operation of patents or developments if thereby a more important public service can be rendered by demonstrating the relative value and pertinency of proposed reforms in business and social administration of such rights, monopolies or other social-economic structures as the corporation may control or operate at a given time.

It is this latter aspect of the corporations' purposes and activities that is felt to be the most nearly unique up to the present time, and these it is hoped will eventually spread to other existing or yet to be created organizations, for this appears a most promising but neglected field of social-economic endeavor and research. In fact, I feel my main justification for being here to-night is what it may mean for the stimulation of just such activity. Perhaps the most impressive lesson that 25 years' experience with Research Corporation has driven home to us is how small a part of the field any one group can or should try to cover. Decentralization of projects and variety of approach, with free and active exchange of knowledge and experience, constitute the ideal program. Each new project of course presupposes sound worth-while new ideas for its technical background and adequate leadership ready to stay with them through thick and thin, but that is just what red-blooded engineers are supposed to have.

(To be concluded)

OBITUARY

WILLIAM MORTON WHEELER

WILLIAM MORTON WHEELER, professor of entomology, emeritus, at Harvard University, died suddenly in Cambridge, on April 19, in his seventy-third year.

Professor Wheeler was born at Milwaukee, Wisconsin, on March 19, 1865. He first attended public school but later transferred to Engelmann's German Academy and graduated from the German-American Normal School, which was appended to the academy. Even as a boy he was intensely interested in natural history and haunted the old museum at the school. In 1884, an incident occurred which was to influence his whole subsequent life. This was the visit to Milwaukee of Professor H. A. Ward, of Ward's Natural Science Establishment in Rochester. Ward brought with him a collection of stuffed and skeletonized mammals, birds, etc., with the idea of having the academy museum converted into a free municipal museum. Then a boy of 19 years, Wheeler helped Professor Ward prepare the collection for exhibition and was offered, and promptly accepted, a position in the Rochester Establishment. His duties consisted of identifying, listing and arranging collections of birds, mammals, shells, echinoderms and sponges. The catalogue of shells which he then prepared is still used by conchologists. In the following spring (1865) he left Ward's and returned to Milwaukee, starting his career as a teacher. Dr. George W. Peckham, who had been making studies on spiders and on the behavior of wasps, induced him to accept a position as teacher of German and physiology in the Milwaukee High School, of which Peckham was principal. Within a very few years the Allis Lake Laboratory was established near the high school, and Professor C. O. Whitman was appointed its director. One of the assistants at the laboratory, Dr. William Patten, taught Wheeler the latest embryological technique and suggested that he investigate the embryology of insects. This resulted (1893) in the publication of Wheeler's "Contribution to Insect Embryology," now recognized as a classic.

Meanwhile, however, the Milwaukee Public Museum

had been established, and in 1887 Wheeler, at the age of twenty-two, was appointed its custodian. He held that position until 1890, when he accepted a fellowship at Clark University under C. O. Whitman. In 1892 Wheeler received his Ph.D. from Clark University, his dissertation being the embryological treatise previously mentioned. The following year (1893–94) he studied at Wurzburg, at Liege and at the Naples Zoological Station. On his return to this country he was appointed instructor in embryology at the University of Chicago, and in 1896 was advanced to assistant professor. In 1899 he went to the University of Texas as professor of zoology. It was while there that he became especially interested in ants. Four years later (1903) he was selected as curator of invertebrate zoology at the American Museum of Natural History in New York. In 1908 he came to Harvard as professor of economic entomology. From 1915 until 1929 he was dean of the Bussey Institution, a graduate school of the university for research in applied biology. In the year 1924–1925 he was exchange professor at the University of Paris, and from 1926 until his retirement in 1933 he was professor of entomology and associate curator of insects at the Museum of Comparative Zoology.

Professor Wheeler's bibliography contains 467 titles. Many of these papers are concerned with the classification, structure and behavior of ants, but a considerable number deal with problems of embryology, evolution, parasitism and the social life of insects in general. Several of these publications appeared in book form, the more notable ones being: "Ants, their Structure, Development and Behavior," "The Social Insects, their Origin and Evolution," "Foibles of Insects and Men" and "Demons of the Dust, a Study of Insect Behavior."[1]

Wheeler had served his apprenticeship as a naturalist before his formal education in zoology really began, and this was perhaps the greatest good fortune of his life. Indeed many of his friends feel, and have always felt, that the full development of his great qualities was in this way facilitated and assured. In thought and feeling he was a practitioner *and* a theorist; a specialist of the first rank, and, in the ancient sense, a philosopher; a great professor, a man of vast encyclopedic learning and the least pedantic of men; a diagnostician of genius who could instantly recognize the significant patterns in things and events, but who confirmed his conclusions by meticulous and systematic observation and study. He always had and never lost satisfaction in the pursuit of minute detail and in the accumulation of facts, so that hard work was a necessity of his being, but he could set no limits, within his wide competency, to the scope of his thought or to its sources or to its reference. All these traits, or at least their full development, he believed partly the result of his peculiar training, and he was in the habit of attributing similar things to similar experiences in other cases than his own.

Observation of the social insects in the field led Wheeler—it could not fail to lead such a man, so conditioned and so oriented—to ecology, to psychology and to sociology. He worked long and hard at insect ecology, insect behavior and insect sociology, and in so doing found a most acceptable complement to his taxonomic work. But more than this, he made of himself a learned sociologist and psychologist and a master of the comparative branches of these sciences. It was such studies especially that directed his later thinking about evolution, that made him sceptical of the sufficiency of experimental evidence against the inheritance of acquired characters, that tempered his enthusiasm for the results and theories of the geneticists as a sufficient explanation of the mechanism of evolution, and that won his sympathy, warm though qualified, for the theory of emergent evolution. These studies also chiefly determined his philosophical position, so different from that of many of those who base their position on mathematics and the physical sciences. Wheeler, like the great physicians, could not forget the inconceivable complexity of things as they are and the intricacy of the web of events, but he possessed that intuitive and imaginative understanding which is the naturalist's compensation for his lack of the clear analysis of the physicist. Wheeler's philosophical position was, accordingly, chiefly the result of a naturalist's disciplined imagination and of vast first-hand acquaintance with animals and their behavior.

He was a man of letters. Possibly the most widely read member of his university, and in this respect unique among the men of science, he was also a distinguished prose writer. Both facts were, or seemed to those who knew him, very certainly and deeply characteristic, nothing less than necessary expressions of his personality.

His reading was limited only in the intellectual sphere by a disposition to avoid the more abstract sciences and, perhaps, in matters of taste by other less important preferences. It included the literature of many languages both ancient and modern and every-

[1] Professor Wheeler was the recipient of many honors. Four universities conferred honorary degrees: Sc.D., University of Chicago (1916); Harvard University (1930); Columbia University (1933); and LL.D., University of California (1928). He received the Elliot Medal of the National Academy and the third Leidy Medal from the Philadelphia Academy of Natural Sciences (1931), and in 1934 was made an Officer in the Legion of Honor. The Royal Entomological Society of London, the Entomological Society of France and the Entomological Society of Belgium also elected him an honorary member. He also belonged to the American Academy of Arts and Sciences, the National Academy of Sciences, the American Philosophical Society and the Zoological Society of France.

thing that he thought possibly of even the smallest interest as an addition to his accumulated store of knowledge and experience. His writing was the expression of his sensitive feeling for style and of his ideal of good workmanship. At its best, for instance, in his occasional satirical pieces, like the letter from the king of the termites and in "The Dry-Rot of Academic Biology," it has a force and a polish, not to mention other qualities, that recall Voltaire.

One can appraise the contributions which an unusual man has made to the civilization of his time. It is almost impossible, however, to convey in words the personality compounded of intellectual and spiritual qualities which characterize the individual as a whole and lend him the flavor and charm that make his death an utterly irreparable loss to his friends. It is quite certain that Wheeler never thought of himself as a great man. In so many ways he was the superior of those about him and his learning and originality were so freely acknowledged that a certain amount of the conceit not uncommon in lesser men might have been excusable. To some extent his sense of humor saved him from this. Like all really great men, he was extraordinarily good company. He laughed with one and, inoffensively, at one; and he was one of the very rare individuals whose idiomatic knowledge of three or four languages was such that he could laugh with equal gusto in all of them. During his later years, he spent most of his evenings in his study in West Cedar Street where one would find him sitting at a deskful of books—with more books on chairs and on the floor and with sheets of manuscript scattered under and over them. The casual visitor was installed in an armchair and the maid sent down for a bottle and the cigars. He had always read some book that other people read later—often at his instigation. His conversation would pick up from this or from some reminiscence that might lead in almost any direction from classical literature to recent discoveries of science. It was difficult to find anything of importance that he had not read—and the scope of his reading ranged from Wilhelm Busch and Alice in Wonderland to Whitehead, who himself regarded Wheeler as one of the greatest men he had ever met. A student has written the following to Mrs. Wheeler: "In a recent lecture, Professor Whitehead characterized him as the only man he had ever known who would have been both worthy and able to sustain a conversation with Aristotle."

A highly developed specialist in his own calling, Wheeler was more completely the intellectual man of the world than any but a very few of his contemporaries in this or any other country. One never left him without having learned something, and one walked down the hill after an evening with him with ever-renewed admiration and affection—and usually with a chuckle.

The death of a great naturalist, like that of a great physician, does more than put an end to a scientific career. It destroys an accumulation and synthesis of knowledge, skill, judgment and experience that can not be transmitted and preserved, because it is as yet incommunicable. To some of Wheeler's friends and colleagues these things seemed the best part of what by devotion, industry, enthusiasm and high intelligence he had made of himself professionally, an achievement even greater than his contributions to science and never to be replaced.

His written contributions to his subject will perpetuate his scientific memory, and his less technical writings will be read with interest and amusement for a long time to come. But as a personality, Wheeler was one of the great experiences in the lives of his friends and, in this sense, he will not really die until all those who knew him well are gone.

L. J. HENDERSON
THOMAS BARBOUR
F. M. CARPENTER
HANS ZINSSER

RECENT DEATHS AND MEMORIALS

FREDERIC EUGENE IVES, distinguished for his work on photographic processes, especially on photoengraving and color photography, died on May 27 at the age of eighty-one years.

DR. L. B. WALTON, professor of biology at Kenyon College, Gambier, Ohio, died suddenly on May 15 at the age of sixty-six years.

GEORGE ROBERT MCDERMOTT, emeritus professor of structurel design at Cornell University, died on May 26 at the age of seventy-six years.

PROFESSOR LUDOLF VON KREHL, director of the Kaiser Wilhelm Institute for Medical Research, known for his work on the physiology and pathology of the circulatory system, died on May 26 at the age of seventy-six years.

DR. ALFRED ADLER, of Vienna, known for his work in psychiatry and psychology, who has been lecturing in England and in the United States, died suddenly on May 29 at the age of sixty-seven years.

A CORRESPONDENT writes: "Dr. Joseph A. Culler, emeritus professor of physics at Miami University, died on May 18 at the age of seventy-nine years. Graduating from Wooster in 1884, he received the A.M. degree two years later from the same institution and the Ph.D. in 1900. From 1903 to 1927 he was professor of physics at Miami University. Dr. Culler

was a tireless experimenter. A pioneer in the field of x-rays, he lost a considerable portion of one hand before the necessity of caution was known. But this did not long interfere with his experimental work, in which he persisted until a few months ago. He was the author of several texts which were favorably known and several monographs as well. He has for many years served his community in various official capacities. Above all he was loved for his gentle, kindly spirit. His memory will be revered by his colleagues on the faculty and by many thousands of students."

HOMAGE was paid at Media, Pa., on May 13 to the memory of Daniel Garrison Brinton, formerly professor of anthropology at the University of Pennsylvania, on the hundredth anniversary of his birth. Dr. Brinton, a native of Thornbury, near Media, died in 1899. The speakers were George L. Pennock, president of the Delaware County Institute of Science; Dr. Edwin G. Conklin, executive vice-president of the American Philosophical Society; Dr. Clark Wissler, of Yale University and the American Museum of Natural History; Dr. Frank G. Speck, of the University of Pennsylvania, and Burgess W. L. Rhodes, of Media.

A BRONZE plaque has been unveiled in the Chapel of St. Joseph of Arimathaea, Washington, D. C., in tribute to Dr. William Holland Wilmer, professor of ophthalmology in the School of Medicine of Georgetown University, 1906–1925. In 1925 Dr. Wilmer became professor of ophthalmology at the Johns Hopkins University School of Medicine; ophthalmologist-in-chief at the Johns Hopkins Hospital and director of the Wilmer Institute. He retired in 1934 and died on March 12, 1936, when he was seventy-two years old.

SCIENTIFIC EVENTS

THE BIOLOGICAL STATION AT BARENTS SEA

IT is stated in *Nature* that a new biological station is being built by the Academy of Sciences of the U.S.S.R. at Murmansk on the Barents Sea. It is intended for extensive research in morphology, anatomy, embryology, physiology, biochemistry and ecology of sea organisms.

Owing to the penetration of the warm waters of the Atlantic into the Barents Sea, the fauna of the latter is extremely rich and diverse. Of importance is the fact that at Dalnye-Zelenets Bay the water is transparent to a depth of 10 meters and that large stretches of the sea bottom are visible from the surface. The scientific workers at the station will make a detailed study of the problems of evolutionary physiology, embryology and the relationship of the fauna with changed hydrological conditions effected by the Gulf Stream.

The Murmansk biological station will supply biological material to the various research institutes and higher educational institutions of the U.S.S.R. Superintending the building is a special commission consisting of S. A. Zernov (director of the station), L. A. Orbeli, V. I. Vernadsky and N. M. Knipovich, Professor K. M. Deryugin, of the University of Leningrad, Professor L. N. Fedorov, director of the All Union Institute of Experimental Medicine, and Professor I. M. Kreps.

The cost of building the Murmansk Station is estimated at 3½ million roubles, excluding equipment. A scientific library, the zoological, botanical, microbiological and hydrochemical laboratories and the libraries of other departments will be housed in the main building of the station. An aquarium designed for scientific work will be installed on the first floor of this building, while several other aquaria, open to the public, will be erected in the basement of the building. Premises containing students' laboratories will be situated near the central building and will also be equipped with large aquaria. Special interest is attached to an open-air concrete reservoir intended to accommodate large sea animals, including seals.

The spawn of crabs will be brought from the Far East for acclimatization and breeding in the Barents Sea. A special vessel, 30 meters long, built for scientific work in the open sea, will maintain uninterrupted communications between the station and the city of Murmansk.

At the beginning of this year, the Academy of Sciences of the U.S.S.R. commenced extensive work in the Dalnye-Zelenets Bay, east of the Kola Bay (Teriberka district, situated in the Northern Province) for the construction of this biological station, which will be the finest in the Soviet Union. The Soviet architect N. V. Ryumin and his assistants have designed all the buildings.

"VOCABULARY" OF THE INTERNATIONAL ELECTROTECHNICAL COMMISSION

THE International Electrotechnical Commission planned the publication of the first edition of its international "Vocabulary" early this year. This work, undertaken soon after the St. Louis Electrical Congress in 1904, contains some 2,000 scientific and industrial terms used in the various branches of electrotechnics. It is the result of many years of continuous effort by a committee of experts including delegates from Austria, France, Germany, Great Britain, Italy, the Netherlands, Poland, Spain and the United States.

The work is divided into fourteen sections, the first of which covers fundamental and general definitions. The others more specifically deal with machines and transformers; switchgear and control gears; apparatus for scientific and industrial measurements; generation, transmission, distribution; electrical traction; power applications; thermic applications; lighting; electrochemistry; telegraphy, telephony; radiology; electrobiology. Definitions appear in both English and French, the two official languages of the International Electrotechnical Commission; and a translation of terms alone is given in German, Italian, Spanish and Esperanto. It is expected that translation of the terms into additional languages will be undertaken in future editions.

While the committee developing this "International Vocabulary" appreciates that it does not constitute a complete unification of electrotechnical nomenclature, through periodic review and revision based on the constructive criticism of electricians of the world, it should become increasingly valuable to engineers.

The edition will be limited. Copies can be reserved by writing to the United States National Committee of the International Electrotechnical Commission at 29 West 39th Street, New York, N. Y.

FELLOWSHIPS IN THE SCIENCES AWARDED BY THE JOHN SIMON GUGGENHEIM FOUNDATION

THE following appointments to John Simon Guggenheim Memorial Fellowships for work in the sciences have been announced:

Dr. Willem J. Luyten, assistant professor of astronomy in the University of Minnesota, first granted a fellowship by the foundation in the year 1928: Appointed to continue his study of the stars in the Southern Hemisphere in the neighborhood of the Sun.

Dr. Ronold Wyeth Percival King, assistant professor of physics at Lafayette College: Appointed to make an experimental and theoretical study of the application of the Maxwell field equations to circuit problems at ultra-high frequencies. This work will be carried on chiefly at the Kaiser-Wilhelm Institute in Berlin-Dahlem, Germany.

Dr. Hans Mueller, associate professor of physics at the Massachusetts Institute of Technology: Appointed to make a study of the structure and properties of liquids, chiefly at the Cavendish Laboratory of the University of Cambridge.

Dr. Lawrence Olin Brockway, research fellow in chemistry at the California Institute of Technology: Appointed to make a determination of the molecular structures of certain heavy metal carbonyls and to give general consideration to the relations between structure and chemical properties, to be carried on, for the most part, in the laboratories of Professor N. V. Sidgwick, at the University of Oxford.

Dr. Florence Barbara Seibert, professor of biochemistry in the Henry Phipps Institute of the University of Pennsylvania: Appointed to make, with the ultracentrifuge, a study of the molecular sizes and cataphoretic mobilities of the active principle of tuberculin in its antigenic and non-antigenic form, to be carried out in the laboratory of Professor The Svedberg at the University of Uppsala.

Dr. James Batcheller Sumner, professor of biological chemistry at Cornell University: Appointed to make, with the ultracentrifuge, a determination of the molecular weights of certain enzymes and crystalline proteins in Professor Svedberg's laboratories.

Dr. Eric Glendenning Ball, associate in psychological chemistry at the Johns Hopkins University: Appointed to conduct a research on the mechanism of biological oxidations. This study will be conducted in several European laboratories.

Dr. William Clouser Boyd, assistant professor of biochemistry in the Boston University School of Medicine: Reappointed to continue studies of blood groups among peoples in southwestern Asia, as data for anthropological investigations.

Dr. William Louis Straus, Jr., associate in anatomy at the Johns Hopkins University: Appointed to make a study of the embryological development of muscle function with particular reference to the anatomical changes that occur in the peripheral neuro-muscular apparatus from physiological immaturity to physiological maturity, to be carried on at the University of London.

Dr. Samuel Robert Means Reynolds, assistant professor of physiology, Long Island College of Medicine: Appointed to work with Dr. George V. Corner, of the University of Rochester, on the nature of the motility-stimulating action of oestrin upon uterine muscle and to prepare a monograph on the physiology of uterine musculature.

Dr. Allan Lyle Grafflin, associate in anatomy at Harvard University: Reappointed to make possible the continuation of functional and cytological studies of the mammalian and human kidney and their extension to other problems pertaining to cellular activity.

Dr. George W. D. Hamlett, research worker in the U. S. Biological Survey at Baltimore: Reappointed to continue a study of the embryology and the reproductive cycles of various South American mammals. Dr. Hamlett is now in Brazil.

Dr. Sydney William Britton, professor of physiology at the University of Virginia: Appointed to establish headquarters at the Barro Colorado Laboratory in the Canal Zone for the purpose of working on the lower forms of mammalia to be found on the Panama Peninsula. His investigations will deal with the functions of the adrenal cortex and the kidney in primitive mammalian forms and in some of the primates.

Dr. Herbert Shapiro, research assistant in physiology at Princeton University: Appointed to investigate nerve activity at low oxygen pressures. These studies will be conducted at the Plymouth and Naples Marine Biological Laboratories.

Dr. Aaron Clement Waters, associate professor of geology at Stanford University: Appointed to make a comparative study of the cataclastic metamorphic rocks, with

a view to ascertaining the condition of their origin, to be conducted in the highlands of Norway and Scotland.

Dr. Charles Henry Behre, Jr., professor of economic geology at Northwestern University: Appointed to make a comparative study of certain lead-zinc deposits, for the purpose of forming generalizations about the nature and structural control of ore deposition in comparison with the lead-zinc ores in limestones in the Mississippi Valley.

Dr. Donald Keith Adams, assistant professor of psychology at Duke University: Appointed to formulate a comprehensive theory of the structure and growth of mind and its testing by application to the data and problems of child psychology.

Dr. Melville J. Herskovits, professor of anthropology, Northwestern University: Appointed to write a book on primitive economics.

SIGMA XI LECTURES AT THE UNIVERSITY OF CALIFORNIA AT LOS ANGELES

THE following public lectures have been given under the auspices of the University of California at Los Angeles Chapter of the Society of the Sigma Xi, in the academic year 1936–37, under the presidency of Dr. George E. F. Sherwood, professor of mathematics:

September 30, 1936: "Periodogram Analysis," by Dr. Dinsmore Alter, director, Griffith Observatory and Planetarium.

October 28: "Sex Determination and Fish Hybrids," by Dr. Albert W. Bellamy, associate professor of zoology, University of California at Los Angeles.

November 4: "The Use of Magnetic Methods in Chemistry," by Dr. Linus Pauling, professor of chemistry, California Institute of Technology.

December 2: "Earthquakes," by Dr. Beno Gutenberg, professor of geophysics and meteorology, California Institute of Technology.

January 6, 1937: "Genes and Hormones in Sex Determination," by Dr. Richard B. Goldschmidt, professor of zoology, University of California, Berkeley.

February 17: "Bright-Line Astronomical Spectra," by Dr. I. S. Bowen, professor of physics, California Institute of Technology.

March 3: "Recent Advances in the Chemotherapy and Serumtherapy of Hemolytic Streptococcal Infections," by Dr. Ralph R. Mellon, director, Institute of Pathology, Western Pennsylvania Hospital.

March 10: "Studies in Language Disabilities," by Dr. Grace M. Fernald, associate professor of psychology, University of California at Los Angeles.

March 19: "Transmutations of Atomic Nuclei," by Dr. Niels Bohr, professor of physics, University of Copenhagen, and Hitchcock Lecturer, University of California, Berkeley, 1936–37.

March 24: "Plant Growth in Relation to Minute Amounts of Certain Chemical Elements," by Professor Dennis R. Hoagland, professor of plant nutrition, University of California, Berkeley.

April 7: "Visitors from Cosmic Space," by Dr. Frederick C. Leonard, chairman, department of astronomy, University of California at Los Angeles.

May 5: "Some Aspects of the Cosmic-Ray Problem," by Dr. Carl D. Anderson, assistant professor of physics, California Institute of Technology.

May 7: "Did Man Originate in Africa?," by Dr. Robert Broom, South African biologist and paleontologist.

SYMPOSIUM ON THE STRUCTURE OF METALLIC PHASES

A SYMPOSIUM on the structure of metallic phases has been arranged by the department of physics at Cornell University for July 1, 2 and 3. The address of welcome will be made by the president of the university, Dr. Edmund E. Day.

The symposium will deal primarily with the "cooperative phenomena" in solids. The factors determining the stability of phases will be discussed from the standpoint of thermodynamics by Dr. J. C. Slater, of the Massachusetts Institute of Technology; statistics by Dr. J. G. Kirkwood, of Cornell University, and by Dr. F. Bitter, of the Massachusetts Institute of Technology, and the quantum theory by Dr. F. Seitz, of the University of Rochester.

The phenomena which will receive special attention are the changes of structure and ferromagnetism. The first topic is divided under two headings, phase changes of the first kind, characterized by the existence of a latent heat, and those of the second kind, for which there is only a jump of the specific heat at the transformation temperature. The most commonly known phase changes, melting and allotropic transformations, are of the first kind; the experimental material will be presented by Dr. E. R. Jette, of Columbia University. The formation of superlattices, to be discussed by Dr. F. C. Nix, of the Bell Telephone Laboratories, involves generally a phase change of the second kind. In all cases, the speed of the transformation has an important bearing upon its occurrence or non-occurrence, which is seen by the often large effect of annealing, and by phenomena such as the aging of alloys which show that statistical equilibrium is frequently attained only after a very long time. Dr. R. F. Mehl, of the Carnegie Institute of Technology, will discuss these questions and their relation to the diffusion in solids. The relation of ferromagnetism to the general theory of cooperative phenomena will be discussed by Dr. Bitter, who will also show how the ferromagnetic properties of alloys can be correlated with those of the pure metals. The relation of ferromagnetism to the crystal structure and especially the dependence of the magnetization on the direction relative to the crystal axes will be discussed by Dr. L. W. McKeehan, of Yale University, and by Dr. R. M. Bozorth, of the Bell Telephone Laboratories.

An effort is being made to correlate the various reports so that those not familiar with the field may gain a clear understanding of the topics discussed.

The last morning will be devoted to a general coordination and summary of all the papers presented, with Dr. Slater leading the discussion.

The program has been arranged so as to provide ample time for discussion periods both formal and informal. Opportunity for social gatherings will be available. Arrangements will be made for housing those in attendance, including families, in one of the university dormitories for the nights of June 30, July 1 and 2. There will be a registration fee of one dollar for those attending the meetings of the symposium. Further information can be obtained by addressing Dr. R. C. Gibbs, Rockefeller Hall, Ithaca, N. Y.

IN HONOR OF DR. L. O. HOWARD

THE eightieth birthday of Dr. L. O. Howard, which occurs on June 11, was celebrated by Washington entomologists on May 27. Dr. F. C. Bishopp, entomologist of the Bureau of Entomology and Plant Quarantine, and Dr. W. R. Walton, senior entomologist, read a biographical sketch. Other speakers included Dr. Lee A. Strong, chief of the bureau; A. L. Quaintance, formerly assistant chief; A. D. Hopkins, formerly chief of the Forest Insect Division, and N. E. McAdoo, president of the Entomological Society of Washington.

Dr. Howard became chief of the Bureau of Entomology in 1894, having been connected with it since his graduation from Cornell University in 1877. He was head of the bureau until his retirement in 1927, and for four years longer was principal entomologist. He was permanent secretary of the American Association for the Advancement of Science from 1898 to 1919, and president of the association in 1920. In reference to Dr. Howard's scientific work a correspondent writes:

As early as 1888, Dr. Howard achieved international renown because of his notable studies of parasitic hymenoptera (wasp-like insects). Subsequently, insect parasites have been used as an important means of controlling insect pests.

Dr. Howard is famous also for his studies of mosquitoes, which began in 1892, several years before the discovery that mosquitoes transmit malaria, yellow fever and other diseases. When certain mosquito species were identified as disease carriers, Dr. Howard was ready to recommend control measures, particularly the use of kerosene.

The common housefly also attracted Dr. Howard's attention in the field of medical entomology. His book, "The Housefly—Disease Carrier," published in 1911, is largely responsible for the world crusade against the housefly during the last 25 years.

His recommendations for boll-weevil eradication, if followed when this insect was first discovered in Texas, would have saved the South millions of dollars later. In New England, the gipsy moth campaign; in the East Central States, the corn borer control operations, and along the Atlantic Coast, the Japanese beetle warfare, are but a few examples of the efforts to eradicate insect pests which began while Dr. Howard was chief of the Bureau of Entomology.

He wrote a book in 1931 called "The Insect Menace," which awakened wide-spread interest in the dramatic warfare that exists between mankind and the insect world. While optimistic as to the ultimate ability of human beings to retain supremacy over their insect enemies, Dr. Howard in this book focused attention on the need for ever-vigilant measures and a sufficient force of trained entomologists to maintain the continual large-scale control operations necessitated by change in agricultural practices.

SCIENTIFIC NOTES AND NEWS

DR. WILLIAM PRATT GRAHAM, professor of electrical engineering, dean of the College of Applied Science and vice-chancellor of Syracuse University, was elected chancellor on May 29. He had been acting chancellor since the resignation last July of Chancellor Charles Wesley Flint, who is now a bishop of the Methodist Episcopal Church in Atlanta.

AT an informal meeting of the Division of Geological Sciences of Harvard University, on May 24, a collection of studies in mineralogy was presented to Professor Charles Palache as a token of personal regard and an appreciation of his outstanding and still-continuing service to mineralogy. The presentation volume, which forms the current issue of the *American Mineralogist*, contains thirty-five papers by American and European mineralogists and a list of Professor Palache's writings. The short speeches of congratulation emphasized Dr. Palache's eminence as investigator and teacher, collector and curator, and his constant encouragement to every form of mineralogical study.

A GOOD-WILL dinner in honor of Dr. Rodney H. True, who becomes professor emeritus at the close of the academic year, was given by members of the department of botany of the University of Pennsylvania on the evening of May 21 at the Valley Green Inn, near Chestnut Hill. Those present were Dr. H. Lamar Crosby, dean of the Graduate School, and Dr. Paul H. Musser, dean of the College of Arts and Sciences, as guests, and Drs. D. Walter Steckbeck, Irwin Boeshore, William Seifriz, John M. Fogg, Harlan H. York, Conway Zirkle, Edgar T. Wherry, Wesley G. Hutchinson and John K. Edwards.

IN recognition of his completion of twenty-five years of teaching service in food and colloid chemistry at

Columbia University, the former and present doctoral research students of Professor Arthur W. Thomas gave him and Mrs. Thomas a surprise dinner party at the Columbia University Faculty Club on May 22. He was presented with a cap, gown and academic hood in token of their esteem.

DR. WILMER KRUSEN, president of the Philadelphia College of Pharmacy and Science, was the guest of honor at a dinner given for him on May 26 by the alumni association. Dr. Krusen has been president of the college since 1927. For eight years he was director of public health of Philadelphia.

THE University of Pennsylvania on June 9 will confer its doctorate of science on Dr. Florence Rena Sabin, member of the Rockefeller Institute for Medical Research, and on Dr. Lightner Witmer, professor of psychology and founder of the psychological clinic at the university.

THE Michigan College of Mines and Technology at the annual class-day ceremonies on June 4 will confer the degree of doctor of science on Dr. Alexander G. Ruthven, president of the University of Michigan, formerly professor of zoology. The degree of doctor of engineering will be conferred on William L. Honnold, mining engineer, chief aid to Mr. Hoover in Belgium during the war. Dr. Ruthven will be the principal speaker.

THE Holley Medal of the American Society of Mechanical Engineers was presented to Henry Ford at a banquet given on May 20 during the annual convention of the society in Detroit.

ELLIS LOVEJOY, Columbus, research director for the Edward Orton Ceramic Foundation, and Edgar C. Bain, New York City, assistant to the vice-president of the U. S. Steel Corporation, have been awarded by the Ohio State University Benjamin G. Lamme Medals for outstanding achievement in engineering.

THE annual award of the Cyrus Hall McCormick Gold Medal of the American Society of Agricultural Engineers for "outstanding achievement in agricultural engineering" has been made to Professor Chester O. Reed, of the Ohio State University. The presentation will be made at the annual meeting of the society at the University of Illinois.

OFFICERS of the Geological Society of America have been nominated by the council as follows: *President*, Arthur L. Day, Washington, D. C.; *Past President*, Charles Palache, Cambridge, Mass.; *Vice-presidents*, T. Wayland Vaughan, Washington, D. C.; Warren J. Mead, Cambridge, Mass.; Joseph A. Cushman, Sharon, Mass.; N. L. Bowen, Washington, D. C.; *Secretary*, Charles P. Berkey, New York, N. Y.; *Treasurer*, Edward B. Mathews, Baltimore, Md. Additional councilors nominated are: Morley E. Wilson, Ottawa, 193[illegible] John B. Reeside, Jr., Washington, D. C.; Henry [illegible] Buehler, Rolla, Mo., and Elias H. Sellards, Aust[illegible] Texas, 1938–1940. Stephen R. Capps, Washingto[illegible] D. C., was nominated representative on the Nation[illegible] Research Council from July 1, 1938, to June 30, 19[illegible]

PROFESSOR C. H. BEST, of the University of Toron[illegible] was elected on May 25 president of the Canadi[illegible] Physiological Society at its third annual meeting, whi[illegible] was held in London, Ontario. Professor G. H. [illegible] tinger, of Queen's University, Kingston, was nam[illegible] secretary, and Professor E. M. Watson, of the Univ[illegible] sity of Western Ontario, London, treasurer. Co[illegible] cillors elected were: Antonio Barbeau, Montreal U[illegible] versity; Romeo Blanchett, Laval University; J. [illegible] Collip, McGill University; George Hunter, Universi[illegible] of Alberta; H. Wasteneys, University of Toronto, a[illegible] E. G. Young, Dalhousie University.

IRVING G. REIMANN, curator of geology at the Bu[illegible] falo Museum of Science, was elected president of t[illegible] New York State Geological Association, and Profes[illegible] William P. Alexander, assistant curator of educati[illegible] in charge of adult activities, was made secretary, [illegible] the annual meeting held in Syracuse, N. Y., on M[illegible] 8 and 9. The association will hold its annual meeti[illegible] in 1938 at Buffalo with trips to Eighteen-Mile Cre[illegible] and Niagara Gorge.

DR. NORMAN L. BOWEN, petrologist at the Geophy[illegible] ical Laboratory of the Carnegie Institution of Was[illegible] ington, D. C., has been appointed first Charles L[illegible] Hutchinson distinguished service professor in the de[illegible] partment of geology of the University of Chicag[illegible] Professor Bowen will succeed Dr. Albert Johannse[illegible] who has reached the age of retirement after havin[illegible] served for twenty-eight years as professor of petro[illegible] ogy. The Charles L. Hutchinson professorship h[illegible] been established by the Board of Trustees in recogni[illegible] tion of the interest taken by the late Mr. Hutchinso[illegible] in the university, of which he was for many years [illegible] trustee and treasurer, and of Mrs. Frances K. Hu[illegible] chinson.

DR. P. H. EMMETT, who since 1926 has been engage[illegible] in research at the Fixed Nitrogen Research Labora[illegible] tory at the U. S. Department of Agriculture, Was[illegible] ington, has been appointed to the chair of chemic[illegible] and gas engineering in the School of Engineering o[illegible] the Johns Hopkins University. He succeeds Dr. Wi[illegible] bert J. Huff, who resigned recently.

DR. CHARLES W. BALLARD, professor of materi[illegible] medica in the College of Pharmacy, Columbia Univer[illegible] sity, has been named acting dean of the college t[illegible] take the place of Dean Henry V. Arny, whose retire[illegible] ment becomes effective on July 1.

DR. L. H. TIFFANY, professor of botany at the Ohio te University, has been appointed chairman of the partment of botany at Northwestern University.

THE Morris Arboretum of the University of Pennvania has appointed F. R. Fosberg, of the departnt of botany of the University of Hawaii, to a rris Arboretum fellowship for the coming school ar. Mr. Fosberg will carry on his investigations the arboretum and at the department of botany of University of Pennsylvania.

DR. WILLIAM R. FOOTE, of the New Haven Hospital, s been awarded the William Harvey Cushing merial fellowship at Yale University.

Nature prints a list of professors who have left rmany on account of the political situation who are rking at the University of Istanbul. Among these : Professor H. Winsterstein, physiology; Professor Brauner, botany; Professor M. Dember, physicist; ofessor M. von Mieses, mathematics, and nearly rty others, most of whom have been appointed chairs. Professor M. Freundlich, who is at present ofessor of astronomy, leaves at the end of the acamic year for the University of Prague, and Prossor F. Dessauer, professor of röntgenology, is going the University of Fribourg, Switzerland.

DR. IRVIN STEWART, vice-chairman of the Federal mmunications Division, has been appointed chairn of a Committee on Scientific Aids to Learning, pointed by the National Research Council. The offil announcement states that "the purpose of the comttee is to canvass, and to report to the council, the tent to which and the means by which certain methds, data, materials and products of science are and y be applied to learning." Members of the committe include: Dr. James B. Conant, president of Hard University, *chairman;* Vannevar Bush, dean of e School of Engineering, Massachusetts Institute of chnology; L. D. Coffman, president of the Univerty of Minnesota; Frank B. Jewett, president of the ell Telephone Laboratories; Ben D. Wood, associate ofessor of collegiate educational research, Teachers ollege, Columbia University; Bethuel M. Webster, New York, *secretary,* and Ludvig Hektoen, chairan of the National Research Council, member *-officio.*

MEMBERS of the Consulting Board of Cancer Rearch of Columbia University have been appointed follows: Dr. Thomas Hunt Morgan, of the Calirnia Institute of Technology; Dr. William J. Mayo, the Mayo Clinic, Rochester, Minn.; Dr. George H. mken, consulting surgeon at Knickerbocker Hospital d the Presbyterian Medical Center; Dr. Paul M. iesy, professor of chemistry at Newark College of Engineering; Professor Ernest O. Lawrence, of the University of California; and the following members of the faculty of Columbia University: Dr. George B. Pegram, Dr. Edmund B. Wilson, Dr. Gary N. Calkins, Dr. Henry C. Sherman, Dr. Marston T. Bogert, Dr. Bergen Davis and Dr. Eugene H. Pool.

DR. GEORGE W. MCCOY, honorary vice-president of the American Mission to Lepers and for twenty-one years director of the National Institute of Health, will make a study of the leprosy problem in the United States and island possessions for the United States Public Health Service.

DR. F. F. MCKENZIE, cooperative investigator for the University of Missouri in the U. S. Department of Agriculture, has leave of absence. He expects to sail for Europe on July 31 to act as investigator for the department in Norway, Sweden, Denmark, Belgium, France and England.

A PALEONTOLOGICAL expedition, which will spend several months collecting fossil vertebrates in Colorado for the Field Museum of Natural History, left Chicago on May 15. The first members of the party to leave were Bryan Patterson, assistant curator of paleontology, and James H. Quinn, assistant. Elmer S. Riggs, curator of paleontology, will join them a few weeks hence.

FRANK TOSE, chief of exhibits in the California Academy of Sciences, San Francisco, has been selected by the Carnegie Corporation of New York to represent it on a trip to Australia and New Zealand for the purpose of introducing there the latest methods of preparation of natural history habitat groups in the public museums. Mr. Tose has been given leave of absence by the academy for eight months, and will sail for Sydney on June 22.

DR. LEE R. DICE, retiring president of the Michigan Academy of Science and director of the laboratory of vertebrate genetics at the University of Michigan, was guest at a special convocation held for major students and staff members of the Wayne University department of biology. Dr. Dice described a technicolor film on the "Variation in Color and Behavior in Mice, with Special Reference to Those of a Genetic Nature."

DR. CARL GUSTAV JUNG, professor of analytic psychology at the Federal Polytechnical University at Zurich, Switzerland, has been appointed Dwight H. Terry lecturer for 1937–38 at Yale University. He will deliver the lectures next October.

DR. EDMUND V. COWDRY, of Washington University, St. Louis, delivered the annual address of the Kappa Chapter of Phi Sigma Society at the Univer-

sity of Kansas on May 13. His subject was "How Living Cells Manage Their Social Problems."

DR. J. S. L. BROWNE, of the Royal Victoria Hospital, Montreal, on April 26 lectured to the students and staff of the hospital of Duke University on "Studies of Sex Endocrine Physiology of the Female," and on May 3 Dr. David M. Davis, professor of urology at Jefferson Medical College, Philadelphia, lectured on "Chronic Prostatitis."

A CHAPTER of Sigma Xi was installed at the Oregon State College in May, with Dr. W. F. Durand, of Stanford University, national president of the society, acting as installing officer. Seventy-six faculty men and women became charter members. An all-school convocation, called to honor the Sigma Xi chapter, was addressed by Dr. Durand. His subject was "Power and Civilization." The installation ceremony was followed by a banquet, at which Dr. Linus Pauling, an alumnus of the college, and now head of the chemistry division of the California Institute of Technology, was the principal speaker. He spoke on "Hemoglobin and Magnetism." Dr. W. E. Milne, professor of mathematics, was toastmaster for the banquet, and Dr. F. M. Hunter, chancellor of the Oregon System of Higher Education, was a guest. Officers elected by the chapter are: F. O. McMillan, *president*; Dr. Don C. Mote, *vice-president;* W. E. Lawrence, *secretary,* and Dr. D. E. Bullis, *treasurer.*

THE program for the Symposium on Colloid Chemistry to be given at the University of Minnesota, Minneapolis, Minn., on June 10 and 11, and at Rochester, Minn., on June 12 has been completed and is being printed for distribution. Twenty-two papers will be presented at the University of Minnesota on June 10 and 11, and eight papers will be given in Plummer Hall of the Mayo Foundation at Rochester, Minn., on June 12. Professor Herbert Freundlich of University College, London, will open the sessions at Minneapolis as well as those at Rochester. Dorothy Jordon Lloyd, of the British Leather Manufacturers' Research Association, will give the second paper at the first meeting of the symposium. The program of the first day will be largely devoted to problems related to bio-colloids, while the papers of the second day will concern themselves with subjects of general interest to colloid chemists. The meeting at Rochester will be of principal interest to those concerned with the colloid problems of physiology and medicine. While at the Mayo Clinic an opportunity will be offered to visit the laboratories and to learn something of the researches in progress.

DISCUSSION

THE VOLUME OF ENTOMOLOGICAL LITERATURE

WITHOUT meaning to suggest that research in entomology should be in the least abated, it seems timely to direct attention to the volume of literature already published concerning insects. What will be said here about entomological matter doubtlessly applies equally to other aspects of biological science. The *Zoological Record* and the *Review of Applied Entomology* were the sources of the data concerning the number of articles discussed below. Through the kindness of Dr. S. A. Neave and W. L. Sclater, who direct the preparation of these two aids, it was learned that their contents are not duplicated to exceed 10 per cent. On this basis, the number of separate entomological items published between 1913 and 1934, for which period both *Record* and *Review* are available, was not less than 100,935, or an average of 4,588 per year. Adding to this figure the titles cited in the *Record* alone for the years 1864 to 1912, the period preceding the advent of the *Review,* we have a total of about 175,000 articles and books, with an average yearly output for the 70 years from 1864 to 1934 of about 2,500 separately published items.

To this total should be added several hundred articles listed in the several volumes of the International Catalogue of Scientific Literature for 1904 and 1905 that seem not to have been included in the *Zoological Records* for those years. The final total of papers and books already put out by our force of workers is therefore truly overwhelming.

It is true that a considerable body of the published matter, and in particular that of the earlier years, has been absorbed in later publications dealing with the same subjects. Progressive digests have been provided in an inadequate number of revisional taxonomic papers, in bulletins concerning important harmful species, in books on economic entomology and in general texts. Most entomological books are designed largely for classwork. While these books contain useful digests, they do not presume to exhaust the accumulated knowledge concerning the species or features treated. On the other hand, there is a phase of insect literature which has not received even the abridged treatment accorded the outstanding economic species, and has suffered almost complete neglect from book writers. Reference is made here to the field of insect bionomics, with particular reference to the habits and developments of groups not primarily economic. Many thousands of published articles pertaining more or less to the bionomics of scavengers, weed-eaters, predators

d parasites of other insects and a host of forms now ed as secondary or potential pests have not been mmarized in bulletin or book form for the use of dent and professional entomologists. The publica- n of mountains of literature avails little for the in- ase of knowledge so long as the facts remain buried d scattered in the numerous serial publications and diverse languages of the whole scientific world. It obviously impossible for student or professor to emble the data from so large a number of papers, d as a consequence many salient facts are never dis- ered and are never acquired for our use.

The abstract journals perform a very valuable ser- e in providing the essence of individual articles, ny of which would otherwise remain out of reach of st entomologists, owing to their distant origin and eign language difficulties. But such abstracts are gely concerned with economic species or aspects, and oreover leave the subject-matter unassembled and correlated and therefore still oblige the student or rker to expend much time in bringing it together. e usual result of this necessity is that the data re- in unacquired by them. The writer believes, in the e of the mountainous mass of published matter, that tomology should encourage the preparation of occa- nal summary studies of its literature. These would concerned either with species or aspects for which considerable number of bionomic papers have already ppeared but whose essence has not been assembled, ganized, condensed and republished in the form of urce books or comprehensive bulletins for the use the entire profession. Needed are the services of a mber of workers who have the facilities of a good rary at their disposal, who enjoy some freedom from her duties, and are willing to forego research for a riod of years to accomplish this task for the common lfare. The result would probably be more effective r the advancement of the science of entomology than equivalent amount of time and energy devoted to e production of original papers. Dr. Schedl's com- ehensive summary paper on the gipsy moth, a review which appears in the *Journal of Economic Ento- ology* for April, 1937, exemplifies the type of species dy to which reference is here made. The broader pe of summary paper may, for example, deal with e bionomics of a group such as the scavengerous in- cts, the several phytophagous groups of the different ders, or the mammalicolous and avicolous parasites. is true that the taxonomic muddles existing in many milies and other categories of insects hinder studies this type. Moreover, it is fully realized that many ps exist in our knowledge of the habits of 90 per nt. or more of the insects, but these conditions do ot warrant us in withholding the many already avail- le salient facts from the reach of our students and professional men for the several more centuries necessary to develop knowledge to a state of completeness. Moreover, no one will deny that summaries of knowledge, be it ever so fragmentary, are not only instructive to students but serve to point out open areas in which research needs to be done and also afford an impetus to such investigations. What entomology wishes eventually to accomplish is the conversion of detailed facts into general principles or natural laws. These laws will not become established abruptly in a far-off day but take shape gradually as facts supplant the many black spaces of ignorance that still exist in entomological knowledge. Occasional summaries of the sort advocated herein will do more than any other single device toward the revelation of these natural laws in the insect class.

Persons who have attempted to prepare summaries of entomological literature of the types described above encounter bibliographical difficulties which more or less seriously interfere with their desire to make their work thoroughly complete. When hundreds or thousands of titles concerning the subject in hand have been assembled and their essence extracted and finally prepared in organized form for publication, no small number of omissions will be discovered sooner or later. In making selections of articles for his bibliography, the summarizer can judge what pertains to his subject only by the titles of articles listed in bibliographical aids. But numerous essential data are published in papers whose titles do not, and can not, give any hint concerning the inclusion of pertinent facts. As a result these data are overlooked and remain unincorporated in books, and in some instances will long, if not forever, remain buried in the mass of promiscuous publications. This situation does not exist so far as the literature of economic entomology for the years from 1913 to date is concerned, since it is quite adequately placed within reach of all by the complete classified indices of the *Review of Applied Entomology*. Even this excellent work would be made more useful by the addition to its index of such inclusive divisions as phytophagous, parasitic, predacious, scavengerous and references to other food habits of insects. Owing to the tremendous number of species comprehended by entomology, no one can remember to what food groups all the species belong; hence the summarizer is obliged to rely to some degree on the bibliography or abstract journal for such facts.

But the difficulties attending efforts to summarize all essential facts are particularly great in the literature for the years preceding 1913, previous to the advent of the *Review*. Yet they are no less so for all time in the groups which have only minor economic importance but still hold much interest for the bionomist. This situation seems to call for an extension of the

Review plan of indexing and abstracting to include (1) the species that now have only bionomic value and (2) the entire literature published before 1913, the year in which the *Review* began its appearance.

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SELECTION OF FOOD BY THE CILIATE CHILODON

THE work of Schaeffer[1] indicates that amoeboid protozoa are capable of selecting their food. The same investigator[2] also found that such was the case with the flagellate, *Jenningsia diatomophaga*. However, as stated by Bragg[3] (p. 433), "the ability of a ciliated protozoon to select its food is still open to question." From his own observations, Bragg concludes (p. 441) "that *Paramecium trichium* has a limited ability to select its food, (but) that the individuals vary in the amount of selective action which they show. . . ." Calkins,[4] on the other hand, doubts that the continuously feeding *Paramecium* is capable of exercising any selection.

A pertinent observation in this regard was made by the writer upon the feeding habits of an unidentified species of *Chilodon* (continuous feeder). In water which had been fertilized with 0.45 gram of fish meal per liter, and which contained, in numbers per cubic centimeter, 5,152,000 cells of *Scenedesmus*, 124,000 cells of *Chlamydomonas* and 1,900 *Chilodon*, it was found that the ciliates had gorged themselves upon *Chlamydomonas*. Very few individuals, however, were found to have ingested *Scenedesmus*, and then only sparingly, although these algae were present in much greater numbers. Thus, it would appear that, under these conditions at least, *Chilodon* is definitely capable of selecting its food. The degree of selection was greater than that observed by Bragg for *Paramecium*, although, as indicated by that author, individuals varied in the selective action exhibited.

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THE CHEMICAL ATOMIC WEIGHT OF CARBON

IN the 1937 report[1] of the International Committee on Atomic Weights, the chemical atomic weight of carbon was raised from 12.00 to 12.01. This change was made on the basis of the precision combustions of hydrocarbons by Baxter and Hale,[2] whose result confirmed the higher value indicated by gas density and mass spectrographic evidence. In view of the present interest in the atomic weight of carbon it has seemed advisable to make a preliminary report on a determination of atomic weight of this element by the analysis of benzoyl chloride according to the classical method of titration with silver. So far as we can determine, this is the first time acyl halides have been used for this purpose.

Benzoyl chloride was prepared from purified benzoic acid and phosphorus trichloride. The first of these substances was obtained by the oxidation of toluene with alkaline permanganate and was purified by crystallization from water, and finally by sublimation. Phosphorus trichloride was twice distilled in vacuum in an all glass apparatus and the middle fraction was taken for the preparation. The benzoyl chloride was purified by repeated fractionation in evacuated apparatus constructed entirely of pyrex glass. Samples for analysis, weighing approximately 14 g, were collected in small glass bulbs.

For analysis the carefully weighed sample bulb was broken under a 50 per cent. aqueous solution of pyridine under which conditions rapid hydrolysis of the benzoyl chloride occurred. After the collection of the glass fragments in the usual way, the solution was acidified with nitric acid, and the chloride balanced with pure silver. The endpoint was determined nephelometrically.

The analyses of five samples, covering eight distillations, have yielded a value for the atomic weight of carbon very close to 12.010. Since these samples represent the extreme fractions, it seems unlikely that the final value will deviate greatly from this figure.

ARTHUR F. SCOTT
FRANK H. HURLEY, JR.

THE RICE INSTITUTE

THE PUBLICATION OF TROLAND'S PSYCHOPHYSIOLOGY

THE fourth volume of the series of the late Professor Leonard Troland (Harvard University) covering psychophysiology remains unpublished because the publishers of the earlier volumes feel that they should have a guarantee of about $2,500, to be repaid from sales. One of Professor Troland's colleagues has expressed willingness to put the manuscript into shape for publication, and said: "Troland considered this final volume the final and best statement of his views. None of Troland's other books have been subsidized, and most of them have made money, but I can appreciate the (publisher's) attitude towards the fourth volume in a period like the last three or four years—a

[1] Asa A. Schaeffer, *Trans. Tenn. Acad. Sci.*, 1912–13, p. 59; *idem., Jour. Exp. Zool.*, 20: 529, 1916; *idem., Jour. Animal Behavior*, 7: 220, 1917.

[2] *Idem., Trans. Amer. Micros. Soc.*, 37: 177, 1915.

[3] Arthur N. Bragg, *Physiol. Zool.*, 9: 433, 1936.

[4] G. N. Calkins, "The Biology of the Protozoa," p. 607. Philadelphia, 1933.

[1] *Jour. Am. Chem. Soc.*, 59: 219, 1937.

[2] *Jour. Am. Chem. Soc.*, 58: 510, 1936; 59: 506, 1937.

period of uncertainty for the publishers of anything, even best-selling novels."

Since the National Research Council, so I understand, is the residuary legatee of the Troland estate, perhaps you may be willing to publish this note by way of an appeal to any interested person or organization that is in position to make the guarantee, and thus render a service to science. Unless something is done promptly, the book may be lost.

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SCIENTIFIC BOOKS

COLORIMETRY

Handbook of Colorimetry. Prepared by the Staff of the Color Measurement Laboratory, Massachusetts Institute of Technology, under the Direction of Arthur C. Hardy. Pp. 87, Figs. 30, Charts 23. The Technology Press, Mass. Inst. of Tech., Cambridge, Mass., 1936. Price $5.00.

THIS publication contains a detailed description of the method of computing certain colorimetric quantities from spectrophotometric data, together with elaborate tables and graphs greatly facilitating the computations. Its scope can best be indicated by listing the chapter headings and giving a brief abstract of the most important features of each chapter.

(1) *The Physical Basis of Color Specification.* The material in this chapter is general, introducing the reader to the idea of spectrophotometric analysis and giving him a brief preview of the rest of the book.

(2) *Sources of Light.* This chapter discusses the types of illuminants under which samples are ordinarily viewed, such as incandescent illuminants of various color temperatures and the various phases of daylight. Special attention is properly devoted to the three illuminants recommended for colorimetric use by the International Commission on Illumination and known as I. C. I. illuminants A, B and C. Illuminant A is a Planckian radiator or black body, in practice a gas-filled tungsten lamp, operating at a specified color temperature; illuminant B is a combination of illuminant A with a specified light filter yielding a chromaticity and relative energy distribution (in the visible spectrum) approximating those of average noon sunlight; illuminant C is a combination of illuminant A with a filter yielding an approximation to average daylight. Tables are given of the relative energy distribution of each of these three illuminants, values being given at each millimicron from 380 to 780 mμ. Relative energy values are also given at every 10 mμ from 360 to 750 mμ for sunlight above the atmosphere and for average Washington noon sunlight.

(3) *Spectrophotometry.* The effect on the spectral transmission of changing the thickness of a transparent material and the concentration of a transparent solution is discussed and illustrated. The subjects of specular and diffuse transmission and reflection are briefly considered. One statement in this chapter should not be overlooked—". . . it is obvious that every color specification must be accompanied by a complete statement of the geometry of the illuminating beam and the geometry of that portion of the reflected (or transmitted) beam that is evaluated in the measurement."

(4) *The Laws of Color Mixture.* The subtractive and additive methods of mixture are briefly discussed and illustrated. A table of wave-lengths of complementary lights is given; when these lights are mixed together additively in pairs in the proper amounts, they will yield the chromaticity of I. C. I. illuminant C.

(5) *Determination of Tristimulus Values by the Weighted Ordinate Method.* Data are given and the procedure is outlined for computing from a table of spectrophotometric data the amounts of the three hypothetical I. C. I. primaries which the I. C. I. standard observer would require in additive mixture to match the color in question. The three numbers thus computed serve as a fundamental definition of the color of the sample for the specified conditions of illumination and observation used in obtaining the spectrophotometric data. Tables of the tristimulus values for the spectrum of an equal-energy stimulus and for the spectra of illuminants A, B and C, respectively, are given at each millimicron from 380 mμ to 770 mμ (to 740 mμ only for illuminant C).

(6) *Determination of Tristimulus Values by the Selected Ordinate Method.* In this alternative method of deriving tristimulus values the numerous multiplications necessary by the weighted ordinate method are eliminated and the computational labor is reduced to a determination of values of the spectral transmission or reflection quantities at the selected ordinates followed by a simple adding of the numbers so selected. Tables of 30 and 100 selected ordinates for each tristimulus distribution are given for illuminants A, B and C.

(7) *Trichromatic Coefficients.* The respective ratios of each of the tristimulus values to their sum are defined as the trichromatic coefficients (trichromatic coordinates, trilinear coordinates). These coefficients serve to specify the chromaticity of the color. Trichromatic coefficients on the I. C. I. basis are given for a few selected illuminants, and for the spectrum at each millimicron from 380 to 780 mμ.

(8) *Graphical Representation of Colorimetric Data.* This final chapter contains 25 charts, in which the coordinates are the trichromatic coefficients, x and y, on the I. C. I. basis, and on which are plotted lines at suitable intervals to enable one to read values of dominant wave-length and excitation purity for the I. C. I. standard observer and with illuminant C as the reference point from which the dominant wave-length loci diverge. Formulas are given for the interconversion of excitation purity and colorimetric purity. These charts are called "chromaticity diagrams," but it should be remembered in any use of such charts that the I. C. I. coordinate system is such that equal distances in various directions, or in the same direction on various parts of the complete diagram, do not indicate equal chromaticity intervals. The lack of proportionality is often many-fold.

It is well known to experts in colorimetry that the colorimetric method described in this book—*viz.*, spectrophotometry accompanied by colorimetric computations based on data fairly representative of an average normal observer—is the most analytical and fundamental which it is possible to use. As such, it is extremely valuable for record and specification purposes. It enables a control to be placed on master color standards otherwise impossible. Of course, there are various types of work where the spectrophotometric data are sufficient in themselves for the purpose. For such, the Handbook would be of little use. But for those who wish to convert such data to colorimetric terms, so that differences in spectrophotometric data may be understood and expressed colorimetrically, the Handbook is of considerable value. It supplements the work of Judd[1] by enabling dominant wave-lengths and purities to be derived graphically instead of algebraically, although the solution is restricted to illuminant C used both as illuminant and reference point.

In addition to the graphs, the parts of the book which are essentially new are the one-millimicron interpolations of the various functions and the wave-lengths of the selected ordinates. These data are undoubtedly of high accuracy and should be of permanent value, particularly to those wishing to make transformations from the International Commission on Illumination coordinate system to other coordinate systems. However, the usefulness of this work does not depend solely on the amount of new material in it, but on the fact that it contains an exposition of the method and a compilation of data brought together in one volume from diverse sources.

In addition to summarizing what may be found in the "Handbook of Colorimetry," it is equally important to indicate those possibly pertinent things which will not be found in it, things which were obviously outside the purpose of the authors in producing such a work, but which those interested in the subject might expect to find included. One might feel handicapped by the lack of references. One must look elsewhere for a thorough discussion of the controversial subject of the definition of color. Psychometric methods applied to color are not considered. There is no discussion of specific systems of material color standards—color cards, atlases, dictionaries, etc.—and but little about colorimeters or filter photometers, visual or photoelectric.

The chapter on spectrophotometry deals with the quantities measured rather than with the methods of measurement. In the discussion of reflection measurements, however, the distinction between *reflectance* and *apparent reflectance* is not brought out. This distinction is particularly important in the colorimetry of glossy materials, where it is usually desirable to exclude the specular component of the reflected light. The International Commission on Illumination, at the same time that it recommended the use of data defining the standard observer and coordinate system and illuminants A, B and C, also recommended that in the colorimetry of opaque materials, except for special cases, the sample be illuminated unidirectionally at 45° and the reflected light be taken for measurement in a direction normal to the surface. This 45°-normal condition of illumination and observation, or some other condition eliminating the specular component of the reflected light from the measurements, must be used if the colors of glossy materials are to be properly specified. The Handbook ignores this I. C. I. recommendation.

One might differ with the authors on various other matters of definition and emphasis and on certain minor details, but to raise these questions here would detract attention from the main purpose of this review, which is to indicate in brief space the nature and scope of the information to be found in the book. The title appears too broad in that there are many phases of colorimetry not included. However, the authors are to be heartily commended for the emphasis which this work places on the most fundamental of all colorimetric methods. In view of the recent improvements in recording spectrophotometers, to which Professor Hardy has so largely contributed, it becomes of increasing importance that methods of colorimetric computation be speeded up to keep pace. To this end the Handbook is another step forward in the science and practice of colorimetry.

KASSON S. GIBSON

NATIONAL BUREAU OF STANDARDS

[1] The 1931 I. C. I. standard observer and coordinate system for Colorimetry, *Jour. Opt. Soc. Am.*, 23: 359, 1933.

SOCIETIES AND MEETINGS

THE VIRGINIA ACADEMY OF SCIENCE

THE Virginia Academy of Science held its fifteenth nual meeting at the University of Virginia, on May 7 and 8, with a registration of 376. The public dress on Friday night was given by Professor Ernest rlando Lawrence, of the University of California, der the joint auspices of the academy and the iversity of Virginia Chapter of the Society of gma Xi. The subject of his address was "Atoms, ew and Old."

The Academy Prize of $50.00 was awarded to Professor R. G. Henderson, of the Virginia Polytechnic stitute, for a paper entitled "Studies on the Downy ildew Disease of Tobacco," and the Jefferson Gold edal was awarded to Dr. William Branch Porter, of e Medical College of Virginia, for a paper entitled Heart Changes and Physiologic Adjustment in Hookorm Anemia." Honorable mention was also accorded J. R. Dietrich for a paper entitled "Propagation of otential in Discharge Tubes" and to R. W. Quarles d A. F. Benton for a paper entitled "Heats of Abrption of Gases on Sodium Fluoride." One hundred nd seventy-nine papers were presented in the sectional eetings, 39 being in the Section of Astronomy, Mathematics and Physics, 50 in Biology, 29 in Chemistry, 11 Education, 25 in Geology, 17 in Medical Sciences nd 8 in Psychology. There were also very interesting monstrations in some of the sections.

The following officers were elected for the coming ear:

President: Professor D. Maurice Allan, of Hampden-dney College.

Secretary-Treasurer: Dr. E. C. L. Miller, of the Medical ollege of Virginia.

President-elect: Dr. F. L. Robeson, of the Virginia olytechnic Institute.

Member of the Council: Dr. Robert F. Smart, of the niversity of Richmond.

The following are the officers of sections for the oming year:

stronomy, Mathematics and Physics:

Dr. Preston Edwards, of Sweet Briar College, *chairan.*

Dr. Charles H. Wheeler, III, of the University of Richond, *Secretary.*

Biology:

Professor L. L. Hill, of Washington and Lee Univerity, *chairman.*

Dr. Paul M. Patterson, of Hollins College, *sub-chairman or botany.*

Dr. W. L. Threlkeld, of the Virginia Polytechnic Institute, *secretary.*

Chemistry:

Dr. M. J. Murray, of Lynchburg College, *chairman.*

Professor Wm. E. Trout, Jr., of Mary Baldwin College, *secretary.*

Education:

Dr. A. M. Jarman, of the University of Virginia, *chairman.*

Dr. C. E. Myers, of the State Board of Education, *secretary.*

Geology:

Dr. A. A. Pegau, of the University of Virginia, *chairman.*

Wm. M. McGill, of the Virginia Geological Survey, *secretary.*

Medicine:

Dr. H. B. Haag, of the Medical College of Virginia, *chairman.*

Dr. I. D. Wilson, of the Virginia Polytechnic Institute, *secretary.*

Psychology:

Dr. Helen Peak, of Randolph-Macon Woman's College, *chairman.*

Dr. R. H. Henneman, of the College of William and Mary, *secretary.*

Following the meeting there were two field trips, one by the geologists, on Saturday afternoon, and one by the Claytonia Club (botanists) extending over Saturday afternoon and Sunday.

E. C. L. MILLER,
Secretary-Treasurer

THE ALABAMA ACADEMY OF SCIENCE

THE fourteenth annual meeting of the Alabama Academy of Science met on the campus of the University of Alabama, Tuscaloosa, on April 2 and 3, with Dr. Walter B. Jones, state geologist and president of the academy, presiding. This was one of the most successful meetings in the history of the academy, for which 140 members and 60 visitors registered. The meetings were held in the Chemistry and in the new Bureau of Mines Buildings. The Junior Academy, which held its fifth annual meeting at the same time in Smith Hall, was attended by 151 members and visitors, with Dr. James L. Kassner, University, and Mr. Matt J. Lawler, Murphy High School, Mobile, acting as counselors.

Registration began at 8:00 A. M. on Friday. A meeting of the executive committee was held at 10:30; a preliminary business meeting at 11:15, with the final business meeting at 5:15 P. M. The reports of the various committees were given and routine business conducted. A resolution in memoriam for Reverend Bede Knapke, of St. Bernard College, Cullman, who died in January, was read by P. H. Yancey, academy councilor to the American Association for the Advancement of Science.

The following officers were elected for 1937–1938.

President (elect of last year): Roger W. Allen, Alabama Polytechnic Institute, Auburn.

President-elect: P. H. Yancey, Spring Hill College, Mobile.

Secretary: Septima Smith, University (reelected for three years).

Councilor to the American Association for the Advancement of Science: Paul Bales, Howard College, replacing P. H. Yancey, Spring Hill College.

Officers held over from last year are:

Treasurer: B. F. Clark, Birmingham-Southern College (one year).

Editor of the Journal: E. V. Jones, Birmingham-Southern College (two years).

The chairmen of sections, vice-presidents of the academy, elected for next year are as follows:

Section I, Biology and Medical Sciences, J. Gordon Carlson, University, replacing C. M. Farmer, State Teachers College, Troy.

Section II, Chemistry, Physics and Mathematics, George W. Hargreaves, Alabama Polytechnic Institute, Auburn, replacing H. D. Jones, Vanderbilt.

Section III, Geology, Anthropology and Archeology, Peter A. Brannon, Montgomery, replacing J. R. Cudworth, University.

Section IV, Industry, Economics and Geography, John Xan, Howard College, Birmingham, replacing Fred B. Riggan, Stockham Pipe and Fittings Company, Birmingham.

The new officers of the Junior Academy are:

President: Clarence Dudley, Phillips High School.

Vice-president: William Pittman, Shades Cahaba High School.

Secretary: Bebe Faust, Woodlawn High School.

Treasurer: Dawson Kendrick, Woodlawn High School—all in Birmingham.

The Academy Award from the American Association for the Advancement of Science was granted to Dr. Septima Smith, of the Zoology Department, University, for aid in her studies of Alabama dragonflies. Dr. Edgar Allen was elected to honorary membership in the academy. He is the second man in the history of the academy to be so selected. Twenty-five new members joined the academy during the year.

The papers were presented in four sections on Friday afternoon and Saturday morning, with additional demonstrations in Nott Hall, School of Medicine. A Dutch luncheon was served on Friday at noon in the basement of Smith Hall. A tea for members and visitors was held in the Main Exhibition Hall, Smith Hall, on Friday afternoon. On Friday evening the annual banquet was held in the beautiful new dining room at Tutwiler Hall, with Dr. Jack P. Montgomery of the school of chemistry, serving as toastmaster. This was attended by members of both the Junior and the Senior Academy. The feature of the evening was the presidential address, given by Dr. Walter B. Jones on the subject, "Conservation of our Natural Resources." This was followed by the first showing except a preview in Washington, of a two-reel movie entitled "Temples and Peace," a sound picture of the Moundville culture, courtesy of the National Park Service. The invocation was given by the Reverend P. H. Yancey, of Mobile. Dr. George Hutcheson Denny, chancellor of the university, gave the address of welcome, with the response by Peter A. Brannon, curator, Department of Archives and History, Montgomery.

Section III held a geological and archeological field trip on Saturday morning, visiting Mound Park, site of the celebrated Moundville culture, Moundville, Alabama; and the famous Havana gullies, carved in the variegated clays of the Tuscaloosa formation of Cretaceous Age. The trip was conducted by Dr. Walter B. Jones.

The official meeting closed on Saturday at noon with a complimentary barbecue, given by the university in Smith Hall Park.

Many visitors remained for the public lecture on Saturday night by Dr. Edgar Allen, of Yale University, on the subject, "Internal Secretions and Reproduction," held under the auspices of the local Sigma Xi club, by courtesy of the University of Alabama, sponsored by the national organization of Sigma Xi Fraternity. This was accompanied by lantern slides and motion pictures. Field trips to the plant of the Gulf States Paper Corporation, Bryce Hospital, Veterans Facility, University of Alabama, the ravines and bluffs along the Warrior River, and Mound Park filled Saturday afternoon preceding the lecture.

SEPTIMA SMITH,
Secretary

SPECIAL ARTICLES

THE OCCURRENCE IN MAMMALIAN TISSUE OF A LIPID FRACTION ACTING AS INHIBITOR OF BLOOD CLOTTING[1]

WE have found that cerebroside fractions obtained from brain of sheep and pigs contain a substance which acts as inhibitor of the clotting of blood and plasma. While the activity of the inhibitor fractions obtained from different batches of tissue varied considerably, in every case an active fraction could be

[1] This work has been made possible by a grant from the Carnegie Corporation of New York in aid of the study of the mechanism of thrombosis and embolism.

olated which had the same solubility properties. A bstance of similar activity also has been isolated om a crude lipid extract of spinal cord of cattle, hich was kindly placed at our disposal by Dr. D. lein, The Wilson Laboratories, Chicago, Illinois.

The organs were dehydrated with acetone and freed sterols, fats, lecithin and cephalin by exhaustive traction with acetone and ether. It is essential to move the ether-soluble phosphatides as completely as ssible, since otherwise the inhibitor may be over-adowed by the cephalin which, as is well known, tivates blood clotting. The organ powder is then peatedly extracted at boiling temperature with ethyl cohol or a mixture of three parts of methyl alcohol d one part of chloroform. The crude material is ssolved in a mixture of two parts of chloroform and e part of ethyl alcohol. A first crop of cerebrosides obtained on cooling of the solution and further tches are collected by stepwise concentration of the other liquors.

When tested according to the technique recently scribed,[2] the first two or three cerebroside crops thus olated usually show an inhibiting effect on the clotting of chicken plasma, and all but the weakest preparations also markedly inhibit the clotting of blood and chicken plasma activated by addition of muscle xtract. On the basis of its solubility properties a oncentration of the active fraction is possible. It is soluble in acetone, little soluble in cold pyridine and ther, easily soluble in cold glacial acetic acid and loroform, and can be recrystallized from methyl cohol or ethyl acetate. These properties indicate at the inhibitor accompanies the sphingomyelin raction, whereas cerebron and kerasin are devoid of tivity. That sphingomyelin itself does not exert the hibiting effect can, however, be shown by the fact at sphingomyelin preparations purified by precipitation with Reinecke salt[3] are inactive. Our purest reparations contain N and P, but only small amounts f S. It appears highly improbable that heparin, hich has entirely different solubility properties, is e active constituent of this lipid inhibitor. In Tables and II examples of the action of preparations from heep brain and beef spinal cord are given. The hibitor from sheep brain is one of the strongest obained so far.

It may be relevant to point out that the question as whether heparin is the physiological agent which ntrols the fluidity of blood is by no means settled.

[2] E. Chargaff, F. W. Bancroft and M. Stanley-Brown, *Jour. Biol. Chem.*, 115: 149, 1936.

[3] S. J. Thannhauser and P. Setz, *Jour. Biol. Chem.*, 116: 7, 1936.

TABLE I

LIPID INHIBITOR FROM SHEEP BRAIN

Mg in 0.1 cc of plasma or blood	Clotting time minutes		
	Activated chicken plasma	Recalcified oxalated human plasma	Human blood
0	9	2	4
0.031	36	..	...
0.062	54	8	...
0.124	90	18	100
0.249	> 250	51	150
0.498	> 250	82	...

TABLE II

LIPID INHIBITOR FROM BEEF SPINAL CORD

Mg in 0.1 cc of plasma	Clotting time minutes	
	Chicken plasma	Activated chicken plasma
0	97	7
0.10	135	9
0.20	225	14
0.39	255	18
0.78	345	25

In order to isolate heparin from tissue comparatively drastic means are necessary. We have found in experiments which have not yet been published that, when a mild method of extraction is employed, it is impossible to liberate heparin even from liver, in which it is known to occur in considerable amount. It may be that the lipid inhibitor described above will prove of interest in connection with the problem of clotting inhibitors contained in blood and in thrombocytes.[4]

The work here described is being continued and will be published in detail at a later date.

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THE DECOMPOSITION OF YEAST NUCLEIC ACID BY A HEAT RESISTANT ENZYME

IN the course of a study of the action of different extracts of animal tissues upon pneumococci, preparations have been obtained which exhibit a high degree of enzymatic activity upon yeast nucleic acid.[1] The enzyme has been prepared from polymorphonuclear leucocytes and from several organs, especially the liver, pancreas, spleen and lungs of different animal species. It possesses certain interesting properties, which are the same irrespective of the source from which it is prepared.

The enzyme, a polynucleotidase, is remarkably resistant to heat, with a zone of maximum stability

[4] E. Chargaff, F. W. Bancroft and M. Stanley-Brown, *Jour. Biol. Chem.*, 116: 237, 1936.

[1] The author is indebted to Dr. P. A. Levene for supplying him with a sample of yeast nucleic acid.

around pH 4 to pH 5; even at pH 1.5 and pH 7.5 the enzyme can be heated in a boiling water bath for five minutes with only little loss of activity. The rate of action upon yeast nucleic acid increases with temperature up to 75° C.; it then decreases sharply and no appreciable action can be detected at 85° C. When an enzyme-substrate mixture is maintained at 95° C. no enzymatic hydrolysis occurs; if, however, the same mixture is now brought back to a temperature compatible with enzymatic activity (60° C., for instance), the nucleic acid is rapidly decomposed, indicating that the inhibiting effect of high temperatures upon the enzyme-substrate mixtures is completely reversible.

The enzyme appears to be a protein; it is readily salted out in saturated sodium sulfate solutions; it is rapidly decomposed by pepsin, but is very resistant to trypsin and chymotrypsin.

After being acted upon by the polynucleotidase, the yeast nucleic acid becomes soluble in mineral acids and glacial acetic acid; the purified preparations of the enzyme, however, do not release any inorganic phosphorus from yeast nucleic acid or indeed from any phosphoric esters tested. In other words, the enzyme does not behave as a phosphatase. No action could be detected upon thymus nucleic acid.

In 1913 Jones[2] stated that he had observed in a preparation of digested pancreas the existence of a principle capable of breaking down yeast nucleic acid into dinucleotides. This observation does not seem to have been confirmed and the same author himself stated later that "it has been found difficult to repeat this experiment."[3] It appears, however, that the enzyme described in the present paper may be the same as that discovered by Jones.

As stated elsewhere, the same enzyme preparations which decompose yeast nucleic acid are also capable of rendering heat-killed pneumococci Gram negative.[4] It appears possible that the same agent is responsible for both types of actions, since the effect of temperature, of trypsin and of pepsin is common to both reactions. Furthermore, it has been possible to extract from pneumococcus cells a soluble fraction which reacts like nucleic acid and which is readily decomposed by the enzyme.

Finally, it may be stated that several samples of crystalline trypsin and chymotrypsin[5] have been found to contain small amounts of a heat-resistant principle which attacks both yeast nucleic acid and heat-killed pneumococci. Both types of action could be completely eliminated by repeated recrystallizations of the proteolytic enzymes.

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[3] W. Jones, *Monographs on Biochemistry*, 37, 1914.

[4] R. Dubos and C. M. MacLeod, *Proc. Soc. Exp. Biol. and Med.* In press.

[5] The author is indebted to Drs. J. H. Northrop and M. Kunitz for supplying him with several samples of crystalline trypsin and chymotrypsin.

THE PREPARATION OF CRYSTALLINE β-4-GLUCOSIDOSORBITOL AND ITS NONOMETHYL DERIVATIVE

RECENTLY Karrer and Büchi[1] reported on the reduction of cellobiose to β-4-glucosidosorbitol. They failed to obtain the substance in crystalline form or analytically pure. In view of the importance which this method of catalytic reduction is acquiring in the domain of sugar chemistry, we wish to report on the preparation of β-4-glucosidosorbitol in form of beautifully crystalline platelets, melting at 133° C. and having a specific rotation in water, $[\alpha]_D^{25} = -8.7°$.

The reduction of the cellobiose was carried out in aqueous solution under pressure of 100 atmospheres in the presence of Raney's catalyst, the temperature being 75° during 8 hours of each day, the remaining part of each day the temperature remaining at about 25°. The operation lasted 48 hours.

The composition of the substance was C 41.83, H 7.21. Calc. C 41.83, H 7.03.

A single methylation with dimethylsulfate under conditions of West and Holden gave an exhaustively methylated product, which distilled at 170° and 0.2 mm pressure. The specific rotation of the substance was $[\alpha]_D^{25} = -4.93°$ (absolute ethanol) and the composition of the substance was C 53.34, H 9.01, OCH$_3$ 58.91. The theory required C 53.37, H 9.00, OCH$_3$ 59.32.

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[1] P. Karrer and J. Büchi, *Helv. chim. Acta*, 20: 86, 1937.

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